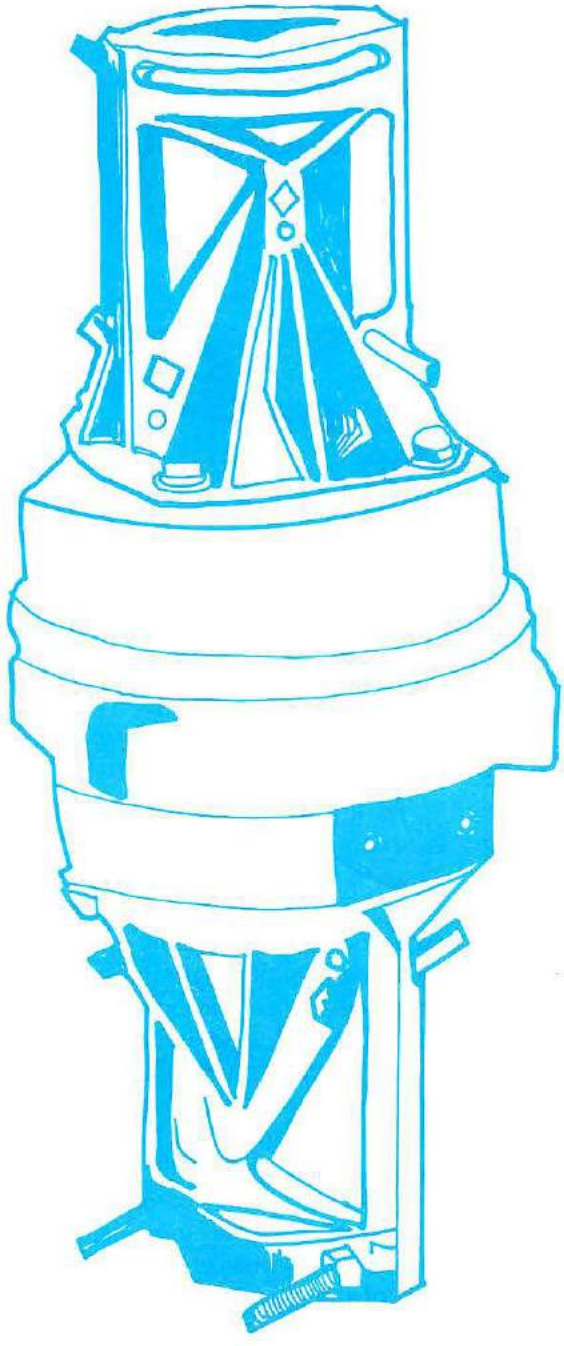
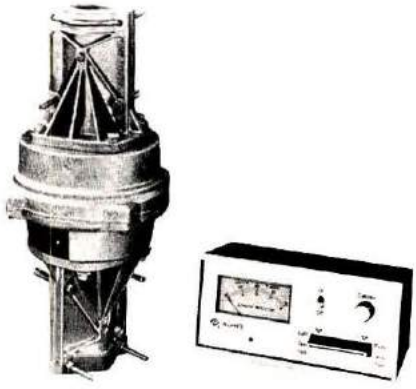


Rotators

An important part of your station is often neglected

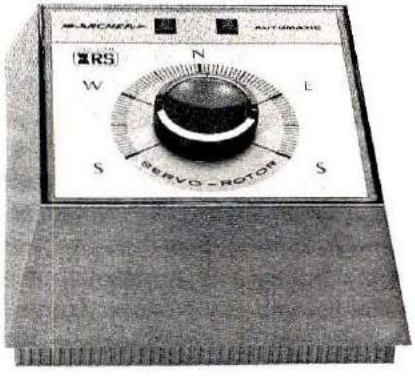
By JOHN EDWARDS WB2IBE

If there were a contest to elect the most ignored piece of Amateur Radio equipment, which item would you vote for? The speaker? On-off switch? VFO dial? How about your transmitter's finals? All very logical choices. There's one device found at many Amateur stations, however, which suffers so severe an identity crisis that even if you own one you probably never even think about it until it suddenly stops working — and then you really miss it! What is this poor station component, so neglected, yet so needed? Why, the antenna rotator, of course!



Above, a heavy-duty rotator with a heavy-duty control box. A meter readout and variable turning speeds are a couple of the extra "goodies" this Alliance Model HD-73 offers (*courtesy Alliance Manufacturing Company*).

Below, the Radio Shack 15-1220 features a pair of lights that indicate left-right turning direction and completion of antenna rotation (*courtesy Radio Shack*).

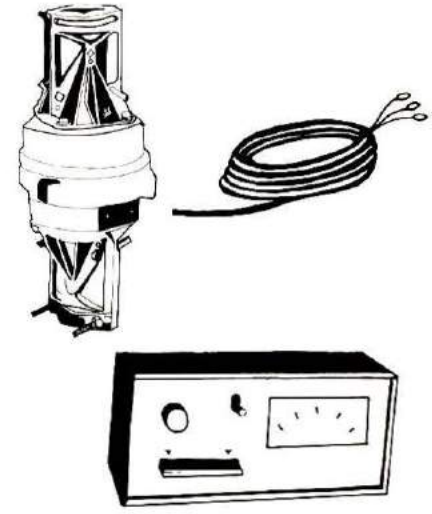


Call it a rotator, rotor, antenna twirler, or whatever, no single piece of ham gear does more work with less praise. At this point, all of you guys with verticals and dipoles are probably smirking and thinking: "Well, that's not my problem." Not quite true. If you've ever harbored the secret dream of someday improving your station and upgrading to a beam or quad, you know that it's your problem, too.

So, there it sits. Through the proverbial snow, rain, sleet, and gloom of night, your rotator awaits your beck and call to aim your trusty skyhook toward that rare DX. Only when it fails to do its job does it merit any attention. What exactly is a rotator? Obviously, it's that piece of machinery that turns your directional-type antenna from one setting to another. Yet, there's more to it than that. The rotator is actually a sophisticated device possessing the brute force to move an antenna array nearing the height of a battleship's superstructure, while maintaining enough finesse to aim that mass of metal right at a distant station.

Still, considering the crucial role a rotator plays in DXing, contesting, or even ragchewing, under less-than-perfect conditions, all too often the choice of a rotator is given second (or lower) priority. While the average ham may spend hours leafing through catalogs and questioning fellow Amateurs about the virtues of different types of antennas (as he should rightly do), the selection of an adequate rotating system is usually an afterthought. The conventional wisdom holds that anything that'll spin an antenna is good enough. However, a few short QSOs on 75 some evening can tell one the folly of this reasoning. The airwaves resound with teary tales of burned-out bearings, and money wasted on turning a small VHF beam with a heavy-duty rotator. The secret of buying the best rotator for your station lies in the type of antennas you need turned.

Rotator components



To know what sort of rotator best suits your station, you'll first have to know a bit about the way they work. When one speaks of rotators, one is actually referring to three distinct parts: the drive unit (the device that actually spins the antenna), the cable leading from the driver into your shack, and the control box. Each of these units plays a vital role, and a fault in any one can result in breakdown of the entire rotator system.

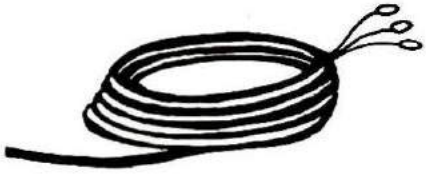
Taking a closer look, starting topside, the drive unit is that section of the rotator most subject to wear and tear and the elements. Unfortunately, it is also the most complex part of the system and the hardest to service. Whether it's mounted on top of a tower or mast or somewhere lower in the superstructure, the driver is, at best, in an awkward position to reach. Therefore, during the installation, it's important to get things done right the first time.

The manufacturer's instructions state that you should always inspect the driver before mounting it. Look it over carefully, taking heed of any damage that may have been done to the unit during

shipping. Once you're satisfied that the driver is in good physical shape, mount it on a solid surface (such as a workbench), and hook it up to the rotator cable and control box. Again, following the instructions, put the driver through a few complete cycles before installing it. Only after this ground-based trial can you be reasonably sure that the rotator is ready to work with your antenna.

If you have the time and space, you might also wish to test the driver's water resistance. To do this, place your rotator in an open spot — such as a backyard or lawn — and gently spray it with a garden hose. (*Keep the control box far away from any possible water contact.* One errant splash can destroy many of the electrical components in the unit.) After the driver is wet, give it a turn or two. If you notice any hesitation or other problem during this test, there may be a leak. For weather protection, most rotators use a small plastic plate that mounts over the rotator-cable contact screws. Before permanent installation, be sure that this plate fits snugly against the driver's body, or you may end up with a shorting problem during wet weather, not to mention eventual corrosion of the cable wire and terminals.

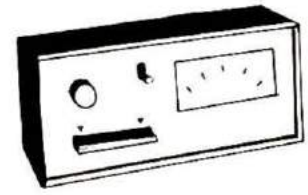
Rotator cable



Depending on the model, a rotator will use from five to eight conductor cable; the exact number determined by the rotator's features and wiring system. Regardless of the quantity of conductors, most cable comes in a flat configuration — vaguely resembling TV lead-in. Regrettably, many brands of cable are not as strong as most Amateur transmission lines. Because of this, extra care should be taken to see that no section of the cable rubs against the edge of your house or tower. If this happens, after a remarkably short period of time, the cable's jacket will wear away exposing the conductors to open air.

Wiring a rotator is just like threading together any other electronics project — care and patience are of extreme importance. The driver and control box each have a set of terminals marked with identical numbers. Since each manufacturer has his own scheme for rotator wiring, we really can't go into specifics here, other than to stress the point of keeping the wires in correct order. Attaching a wire from the number one screw on the control box to the number three terminal on the driver, for instance, may necessitate sending the entire rotator back to the shop. Easy does it, and always double check before applying power.

Control boxes



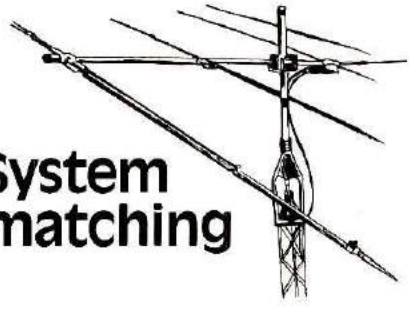
This brings us to the final element of the rotator system: the control box. In just about every way, the controller is the most esthetically pleasing part of the entire setup. However, it's a bad bet just to buy a rotator system on looks alone. While a controller's features can range from variable-speed controls to end-of-rotation LED indicators and a walnut-grain cabinet, remember, you really buy a rotator for the driver, not how well its control unit may blend into your shack's decor.

With this bit of advice aside, let's mention another peculiarity. For a reason best known to rotator manufacturers, heavy-duty rotators — those capable of moving

Table 1. Matching antenna systems to rotators. To help find the correct rotator to turn your antenna, here's a list of some popular rotator models followed by specific types of antennas. The figure after each rotator is the "wind load," and represents the maximum the unit can handle before suffering damage. The figures following the antenna models express the maximum load the system will apply to your rotator. Your job: match your prospective antenna to a suitable rotator.

Rotator Model	Load, Square Feet	Antenna Model	Load Square Feet
Alliance HD-73	10.7	Cushcraft A3 (Tribander)	5.6
Alliance U-100	4.0		
CDE CD45	2.5	Cushcraft Boomer (2m. 19 el.)	3.5
CDE Ham 4	12.5		
Radio Shack 15-1220	2.0	Cushcraft Boomer (6m. 6 ele.)	4.8
Radio Shack 15-1224	2.0		
TET U.S.A. KR400	7.5	Mini Products (Hybrid Quad)	1.5
TET U.S.A. KR2000	32.2		
TET U.S.A. KR600	16.1	Wilson System 36 (Tribander)	8.6
TET U.S.A. KR500	7.5		
		Wilson System 40 (Tribander)	12.1

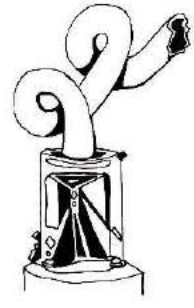
something on the order of a triband beam and up — seem to have all the nifty options, while lightweight rotators tend to be Plain-Janes. This probably has something to do with rotator companies wanting to make their big-ticket items more appealing, but it puts the lightweight-antenna owner in a bind if he fancies a controller that does more than just show him his beam's direction. Now, if you want to buy a heavy-duty rotator to move that 2-meter beam just so you can get a better looking controller, that's between you and your wallet. However, if performance and not looks are what matters to you, then you'll want to get the best buy for your money.



System matching

Getting the best buy for your money means purchasing the rotator specifically suited to your needs. If you've been doing some shopping for directional-type antennas lately, you probably have a lot of manufacturer's literature on hand. Take a close look at some of these brochures; you'll note a statistic called "Surface Area" or "Wind Area." This specification is vital for matching an antenna to a rotator, since it tells the buyer just how much force the skyhook will exert on a rotator's mechanism. For example, a triband beam may have a surface area of 5.7 square feet, while a heavy-duty rotator will handle a system with up to 10.7 square feet of load. With this arrangement, you would have rotating power to spare, even enough to stack a small vhf beam on top of the tribander. However, if you were to use a light-duty rotator, capable of handling only 3 square feet of antenna, your rotator would groan, moan, and eventually self-destruct from the pressure. The principle involved is to use a rotator just slightly more powerful than needed to handle the job. **Table 1** will give you an idea of the sort of antennas you can use with various rotators.

Antenna rotators can handle different loads depending on whether they are mounted on a mast or in a tower. Besides adding height to your antenna system, towers also have the extra advantage of giving your rotator greater protection. Bolted tightly in its perch high above your shack, a tower-mounted rotator is in a much more secure position to handle the strain of turning your antenna than is its mast-mounted counterpart. Wedged between your roof and antenna with only two sections of mast for support, a mastheld rotator fights a continuous struggle against a wind-whipped antenna and an immovable house. While it's perfectly acceptable to mount your rotator on a mast, just remember to heed the reduced loading suggestions outlined in **Table 1**.



Braking

While we're speaking of rotators twisting between sky and earth, it's time to mention the most popular abuse inflicted upon rotators: improper braking. Consider the momentum generated by a huge beam in motion. If you've ever installed a vertical antenna for CB or ham use, remember how tricky it was to hold the assembled structure upright on your roof? One false move, and it felt like you and your antenna were going to take the quick way down! It's the same principle tightrope walkers use at the circus. The inertia produced by the balancing pole (held horizontally in their case) steadies the performer on the wire.

Because of this inertia it's strongly recommended that you shun the common practice of braking your antenna to a sudden stop and then rapidly backing it up after missing your target. Doing this is tantamount to reversing your car on an Interstate after missing an exit. The results on an antenna system can be just as destructive. If you're lucky, you'll only damage some of the rotator's gears and loosen a few mast bolts. On the other hand, if you're unlucky, inertia will keep the beam going in its original direction while the rotator reverses. Your only hope in this instance is to put on a hard-hat and shout, "Look out below!"

Maintenance

After your rotator has been performing its faithful service for a year or two, it's time to take a look topside and see how this most ignored part of your station is making out. You can include this check-up as a part of your periodic antenna maintenance schedule. While you're busy checking your antenna's traps, searching for stress fractures on your tower, and tightening the mast's mounting, give your rotator a look-see. Is there any physical damage to the unit? Are there any leaves or other debris caught around the collar where the mast and driver meet? Are all the screws, lockwashers, and other mechanical parts still in place? If there are any problems, be sure to attend to them at once. Winter has a way of sneaking up, and having your rotator break down in the middle of the DX season is definitely no holiday greeting.

Incidentally, just about every commercially made rotator on the market is lubricated for life, by the

manufacturer, so never go to your driver with an oil can in hand. That's one bit of "maintenance" your rotator can do without. All you'll probably end up doing is gunking up components that shouldn't be contaminated, over-lubricating other spots or, most likely, a combination of the two. If you suspect that the unit really does need oiling, send it back to the factory. Even so, many of the groans and squeaks you may hear from the ground during rotation are probably coming from the usual give and take of the antenna and masting, not the drive unit.

Elevation rotators

For most types of operating, the usual horizontal, or "azimuthal," rotator is fine for contacting stations all around the globe. But what do you do if the "station" you want to reach is flying over your house? That's the unusual problem faced by users of the OSCAR satellites.

To meet the special antenna-pointing demands placed upon the operators of these aerial relay stations, a new generation of rotators has been developed to tilt conventional beams above their traditional horizontal positions. Called "Elevator Rotators," these specially designed units can precisely move a Yagi from a level setting, up to 90 degrees, and even flip the antenna over a full 180 degrees until it's once again on line with the horizon — only now upside down.

The rotator, which mounts on top of any conventional antenna mast, features a second set of brackets to hold a horizontal boom. On this rotating boom can be secured one, two, or even more vhf-uhf beams. The only limit to the number of antennas in any elevating system is the maximum load capabilities of the elevator and azimuthal rotators used to control the installation.

OSCAR beams are usually placed either on a separate mast, or on the very top of an existing antenna system. The reason for this special mounting procedure is twofold. Besides the physical law that dictates you should always stack antennas in an ascending order of frequency coverage, it would also be a waste of rotating power to tilt your entire lowband antenna set-up along with your OSCAR beam.

Rotator horizons

Although we often forget, being a Radio Amateur means searching for new horizons, forging into obscure territory where professionals, because of financial and time constraints, never bother to look. Just as fresh frontiers can be covered in propagation research and electronics design, rotator development is another area ripe for exploration. Perhaps the most exciting innovation to affect rotators in recent years has been the introduction of microcomputer-controlled antenna systems. In increasing numbers, Amateurs are hooking both their azimuthal and elevator rotators into home computer systems. With this space-age set-up, after plugging in the correct program, the antenna will automatically follow OSCAR's path, relieving its operator of any need to fiddle with settings.

This new technology isn't limited to satellite work — good old-fashioned DXing can also benefit from the micro's aid. Imagine just typing the name of a city or prefix into a computer, and having your antenna zero right in on target. Don't know where ST

An elevation rotator used for tilting vhf antennas and arrays toward OSCAR satellites (*courtesy TET U.S.A.*)

Table 2. Specifications and prices of some popular rotators.

Brand	Model	Duty	Mast size Inches, O.D.	Rotation Time Seconds	Degrees	Accuracy	Price
Alliance	HD-73	Heavy	1-3/8 to 2-1/2	60	360	5°	$119.95
Alliance	U-100	Light	1-3/8 to 2-1/2	60	360	5°	$49.95
CDE	CD45	Medium	1-1/2 to 2-1/2	60	360	5°	$110.00
CDE	Ham 4	Heavy	1-1/2 to 2-1/2	60	360	5°	$499.95
CDE	Tailtwister	Ex. Heavy	1-1/2 to 2-1/2	60	360	5°	$209.00
HyGain	HDR300	Heavy	1-3/4 to 3	60	395	1°	$499.95
Radio Shack	15-1220	Light	1-1/4 to 2-1/8	60	360	10°	$64.95
Radio Shack	15-1224	Light	1-1/4 to 2-1/8	60	360	10°	$52.95
TET U.S.A.	KR400	Medium	1-1/2 to 2-1/2	50	360	5°	$84.95
TET U.S.A.	KR2000	Ex. Heavy	2 to 2-1/2	67	370	5°	$289.95
TET U.S.A.	KR600	Heavy	1-1/2 to 2-1/2	53	360	5°	$139.95
TET U.S.A.	KR500 (Elevator)	Medium	1-1/4 to 1-5/8	61	180	3%	$149.95

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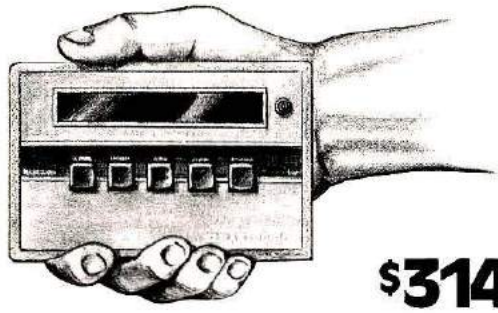

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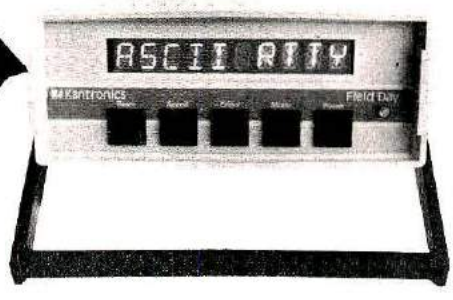

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land is? No matter, just punch in the prefix and the computer's video diplay will automatically tell you the country's name (Sudan, in this case) while simultaneously aiming your beam in the right direction. Perhaps, someday, we'll even have scanning systems that'll continuously rotate a beam while automatically picking up the best signal bearing — all without even making the operator look at his S meter. Time will tell.

Armstrong rotators

Elevator rotators, microcomputers — pretty fancy ways to turn an antenna, especially when you consider that until a few years ago the most popular antenna twister was the good old "armstrong rotator." No, this device wasn't named after Major Edwin H. Armstrong, inventor of FM radio, or some other famous wireless pioneer. Instead, it was actually named after an item found in almost any Amateur station. To use this type of rotator, bracket an antenna to the side of your house, making sure that its mast (which should be loosely held in the bracket) extends past your shack's window. Then, reach out with your *arm* and *strongly* turn the antenna in any direction you wish. Unlike conventional rotators, it's pretty hard to ignore the armstrong job. It's always "at hand," you might say.

For more information

Alliance Manufacturing Company, Inc., 22790 Lake Park Blvd., Alliance, Ohio 44601; 216-821-5360.

Cornell-Dubilier Electric Corp. (CDE), 150 Avenue L, Newark, New Jersey 07101.

Radio Shack, One Tandy Center, Fort Worth, Texas 76102.

TET U.S.A., 425 Highland Parkway, Norman, Oklahoma 73069; 405-360-6410.

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